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For two-letter codes and other abbreviations. refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SECURITY SYSTEM
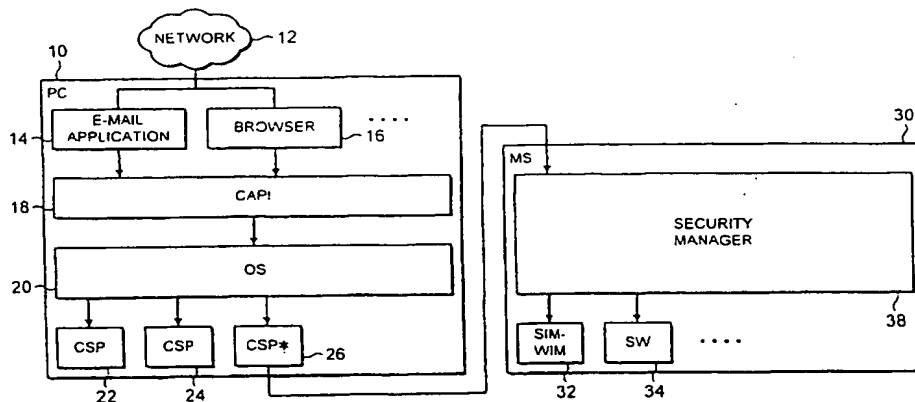
(57) Abstract: A communications device, which has a cryptographic module for use in mobile communications, can be used as a cryptographic services provider. For example, the device may be a device which can operate under the Wireless Application Protocol, that is, a WAP-enabled device, such as a mobile phone. This has the advantage that WAP-enabled devices include components which are used in public key/private key cryptographic systems as a part of their standard communication functions. These components therefore advantageously allow the device to be used as a cryptographic services provider. Advantageously, the device can use Wireless Transport Layer Security (WTLS) for mobile communications, and employs its cryptographic module when in use as a cryptographic services provider.

SECURITY SYSTEM

TECHNICAL FIELD OF THE INVENTION

This invention relates to computer systems, and in
particular to the improvement of security in such
5   systems. More specifically, the invention relates to a
method for improving the security of communications,
for example over a computer network, although it is
also applicable to increasing the security of a
computer system.

10   BACKGROUND OF THE INVENTION

US-5,689,565 describes a cryptography system
architecture for a computer, which provides
cryptographic functionality to support an application
which requires cryptography. The cryptography system
15   has a cryptographic application program interface
(CAPI) which interfaces with the application to receive
requests for cryptographic functions. The system
further includes at least one cryptographic service
provider (CSP) that is independent from, but
20   dynamically accessible by, the CAPI. The CSP provides
the cryptographic functionality and manages the secret
cryptographic keys.

This system architecture is used in many
applications in which data may desirably be transferred
25   across unsecured computer networks such as the
internet. For example, this architecture can be used
in applications such as email clients, web browsers,
etc. A similar architecture can be used for access
control within a computer system, and for hard disc
30   encryption.

US-6,038,551 describes a development of the
architecture disclosed in US-5,689,565, in which the
computer includes a card reader, and an integrated
circuit card (IC card) stores the cryptographic keys
35   used by the CSP in the computer, and can perform

is taken to specify the presence of stated features,
integers, steps or components but does not preclude the
presence or addition of one or more other features,
integers, steps, components or groups thereof.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a block schematic diagram of a first
system implementing the present invention.

Figure 2 is a flow chart showing the operation of
the system of Figure 1.

Figure 3 is a flow chart showing in more detail a
part of the operation illustrated in Figure 2.

Figure 4 is a block schematic diagram of a second
system implementing the present invention.

Figure 5 is a block schematic diagram of a third
system implementing the present invention.

Figure 6 is a flow chart showing the operation of
the system of Figure 5.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 is a block schematic diagram of a
computer system, including a personal computer (PC) 10,
only the relevant components of which are shown. It
will be apparent that, in this embodiment of the
invention, and in the other illustrated embodiments,
any computer system can be used in exactly the same way
as the PC 10.

The computer has a connection to an external
network 12, for example through a modem (not shown).
Of particular concern here is the situation where the
computer 10 is connected to an unsecured network, such
as the internet.

The computer 10 has various software applications
which require external communication, such as an email
application 14, and a web browser 16, which use Secure
Socket Layer (SSL) and/or Transport Layer Security
(TLS) security. In many cases, the information which

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Transport Layer Security (WTLS) can be used. This
provides confidentiality for users, by encrypting
messages which are transmitted over the wireless
interface, and also provides authentication, by means
5   of digital certificates.

In order to provide this WTLS functionality, the
WAP-enabled device 30 includes a cryptographic module,
which uses an embedded public key and private key on
handshake for authentication, then generates symmetric
10   session keys, which are used to encode messages before
transmission and to decode received messages.

For example, the phone 30 may also include a
Subscriber Identity Module - Wireless Identity Module
(SIM-WIM) card 32, which is used to identify the
15   subscriber, and can contain the cryptographic module.
Alternatively, the cryptographic module can be realised
in hardware or in software 34 in the phone 30, or may
be provided on an external smart card. In order to
access the cryptographic module, the MS 30 includes a
20   security manager module 38. The operation of these
devices will be explained further below.

In accordance with preferred embodiments of the
present invention, the cryptographic module of the
phone, and other features which are used to provide
25   secure communication using the Wireless Application
Protocol, also allow the phone 30 to be provide some or
all of the functionality of a cryptography service
provider.

In the case where the cryptographic module is
30   embodied in hardware, the necessary information is
provided on an integrated circuit in the device.

 Where the Wireless Public Key Infrastructure
(WPKI) is used to distribute the parameters for WTLS,
it can also be used to distribute the parameters
35   required for use as a cryptography service provider.

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provider and the MS are possible.

Figure 2 is a flow chart showing a method by which
the PC 10 can use the cryptographic functionality in
the mobile phone 30.

5   The procedure starts with step 100, in which the
application in the PC 10, such as the email application
14 or web browser 16 determines that cryptographic
functionality is required, and sends a command to the
CAPI 18. The cryptographic functionality which is
10   required may for example be encryption, decryption,
hash generation, message signing, verification, key
generation, certificate management, or random number
generation. Other types of cryptographic functionality
which may be provided are described in the PKCS#11
15   standard mentioned above.

In step 102, the CAPI selects an appropriate CSP
to provide the cryptography function. In this case,
the CAPI selects the CSP* 26, which can access the
cryptographic module in the MS 30.

20   In step 104, the CAPI 18 establishes communication
with the selected CSP* 26, and the CSP* 26 establishes
communications with the MS 30. As discussed above, the
communications between the PC 10 and MS 30 can
advantageously be over a Bluetooth short range radio
25   link.

In step 106, the operating system (OS) 20 verifies
the authenticity of the CSP*. It will be noted that
this step may be unnecessary if the authenticity of the
CSP* has already been established as part of an earlier
30   process. As an alternative, this step can be carried
out earlier in the process, and other changes in the
order of the illustrated steps are also possible.

In step 108, a message is passed from the CAPI 18
via the CSP* 26 to the MS 30, with details of the
35   cryptographic operation which is required.

communication.with the hard disc 52. Since the
information which is stored on the hard disc may be
confidential, the application restricts access thereto,
so that only authorised persons can gain access to it.

5   As is conventional, therefore, the hard disc
application 50 can call a cryptographic application
program interface (CAPI) 18, which is provided on top
of the operating system (OS) 20.

        As is also conventional, the cryptographic

10   application program interface (CAPI) 18 can access one
or more cryptography service providers (CSPs) 22, 24.

        Different cryptography service providers (CSPs)
may, for example, use different cryptographic
algorithms, and may be used for different purposes.

15   In accordance with the present invention, as
described in more detail with reference to Figures 1-3,
some or all of the functionality of a cryptography
service provider is available on a separate device,
namely a mobile station (MS) 30, and the CSP* 26 can

20   call the required functionality from the MS 30.

        The mobile station may be exactly as described
with reference to Figures 1 and 3 above.

        Figure 5 shows a further alternative system in
accordance with the invention.

25   Again, the computer system is described with
reference to a personal computer (PC) 60, but it will
be apparent that any computer system can be used in
exactly the same way as the PC 60.

        The computer has a connection to an external

30   network 12, for example through a modem (not shown) to
an unsecured network, such as the internet.

        The computer 60 has various software applications
which require external communication, such as an email
application 14, and a web browser 16, which use Secure

35   Socket Layer (SSL) and/or Transport Layer Security

the Bluetooth short-range radio transmission protocol,
although an infrared connection is also possible. The
protocol for the connection can for example be based on
AT commands, and provides security for those
communications. The command set is advantageously a
version of the command set defined in a standard such
as PKCS#11, described in the document "PKCS#11 v2.10:
Cryptographic Token Interface Standard", published by
RSA Security Inc. and incorporated herein by reference,
where the commands are redefined as AT commands.

Figure 6 is a flow chart showing a method by which
the PC 60 can use the cryptographic functionality in
the mobile phone 30.

The procedure starts with step 160, in which the
application in the PC 60, such as the email application
14 or web browser 16 determines that cryptographic
functionality is required, and sends a command to the
PKCS#11 interface 70. The cryptographic functionality
which is required may for example be encryption,
decryption, hash generation, message signing,
verification, key generation, certificate management or
random number generation.

In step 162, the PKCS#11 interface 70 selects an
appropriate CT to provide the cryptography function.
In this case, the PKCS#11 interface 70 selects the CT*
76, which can access the cryptographic module in the MS
30.

In step 164, the PKCS#11 interface 70 establishes
communication between the application and the selected
CT* 76, and the CT* 76 establishes communications with
the MS 30. As discussed above, the communications
between the PC 60 and MS 30 can advantageously be over
a Bluetooth short range radio link.

In step 166, a message is passed from the PKCS#11
interface 70 to the MS 30, calling the cryptographic

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CLAIMS

1.   A method of encrypting communications from a
computer having an application program interface, the
method comprising using a mobile communications device,
5   which includes a cryptographic module for use in mobile
communication, as a cryptographic service provider.

2.   A method as claimed in claim 1, wherein the
mobile communications device is a WAP-enabled device.

3.   A method as claimed in claim 1 or 2, wherein
10   the cryptographic module is that used by the mobile
communications device for Wireless Transport Layer
Security communications.

4.   A method as claimed in claim 1, 2 or 3,
comprising providing a wired connection between the
15   mobile communications device and the computer.

5.   A method as claimed in claim 1, 2 or 3,
comprising providing a wireless connection between the
mobile communications device and the computer.

6.   A method as claimed in any of claims 1 to 5,
20   comprising:

when the application program interface requires
cryptographic functionality, calling a cryptographic
service provider function in the mobile communications
device.

25   7.   A mobile communications device, comprising a
cryptographic module, the cryptographic module being
usable:

(a) for encoding wireless communications from the
device;

30   (b) in a cryptographic service provider with an
application program interface of a remote computer.

8.   A mobile communications device as claimed in
claim 7, having a short-range wireless communications
transceiver, for sending signals to and receiving
35   signals from the remote computer.

to said command.

19.   A module for a personal computer, wherein, in response to the module receiving a first command from a cryptographic application program interface, indicating that it requires cryptographic functionality, the module sends a second command to a mobile communication device, such that the mobile communications device acts as a cryptographic service provider for said personal computer.

20.   A method of encrypting computer communications, the method comprising using a separate mobile communications device, which includes a cryptographic module for use in mobile communication, as a cryptographic service provider.

21.   A method as claimed in claim 20, wherein the mobile communications device is a WAP-enabled device.

22.   A method as claimed in claim 20 or 21, wherein the cryptographic module is that used by the mobile communications device for Wireless Transport Layer Security communications.

23.   A method as claimed in claim 20, 21 or 22, comprising providing a wireless connection between the mobile communications device and the computer.

24.   A computer system, comprising:

a computer; and

a mobile communications device, including a cryptographic module,

the computer having at least one application which requires cryptographic functionality,

a first part of the required cryptographic functionality being provided in the computer, and a second part of the required cryptographic functionality being provided in the mobile communications device,

the computer and the mobile communications device having means for establishing a secure communications

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device.

32.   A method as claimed in claim 28, comprising using a cryptographic module realised in hardware in the mobile communications device.

33.   A method as claimed in claim 28, comprising using a cryptographic module realised in software in the mobile communications device.

34.   A method as claimed in claim 28, comprising using a cryptographic module provided on an external smart card which can be read by the mobile communications device.

35.   A method as claimed in claim 28, comprising using a cryptographic module a Wireless Identity Module (WIM) card in said mobile communications device.

36.   A computer system for supporting an application, the computer system comprising:

a cryptographic application program interface; and

a cryptography service provider,

wherein, when the cryptographic application program interface determines that the application requires cryptographic functionality, sends a command to the cryptography service provider, and

wherein the cryptography service provider has a communications link to a cryptographic module of a mobile communications device, the cryptographic module of the mobile communications device being usable to encrypt communications between the mobile communications device and a telecommunications network over a wireless interface, and

wherein the cryptography service provider can obtain the cryptographic functionality, required by the application, from the cryptographic module of the mobile communications device.

37.   A system as claimed in claim 36, wherein the cryptographic module is realised in hardware in the

mobile communications device further comprising a
security manager module for receiving commands from a
computer system over a second interface, wherein, in
response to suitable commands received from the
5   computer system over the second interface, the security
manager module requests a cryptographic function from
the cryptographic module, and returns the results of
the cryptographic function to the computer system over
the second interface.

10   45.   A mobile communications device as claimed in
claim 44, wherein the security manager module responds
to a command set defined in a standard PKCS#11, where
the commands are redefined as AT commands.

46.   A mobile communications device as claimed
15   in claim 44, wherein the second interface is a
Bluetooth short-range radio interface.

47.   A module for a computer system, the module
comprising:

an application interface for connection to a
20   computer application; and

an external interface for connection to a mobile
communication device containing a cryptographic module;

wherein, when the module receives from the
application interface a request for a cryptographic
25   function which the module is unable to provide, the
module sends a command over the external interface to
the mobile communications device to request the
cryptographic function therefrom.

48.   A module for a computer system as claimed in
30   claim 47, wherein the module has some cryptographic
functionality, and comprises means for determining in
response to a request from the application interface
whether it is able to provide the requested function
cryptographic function.

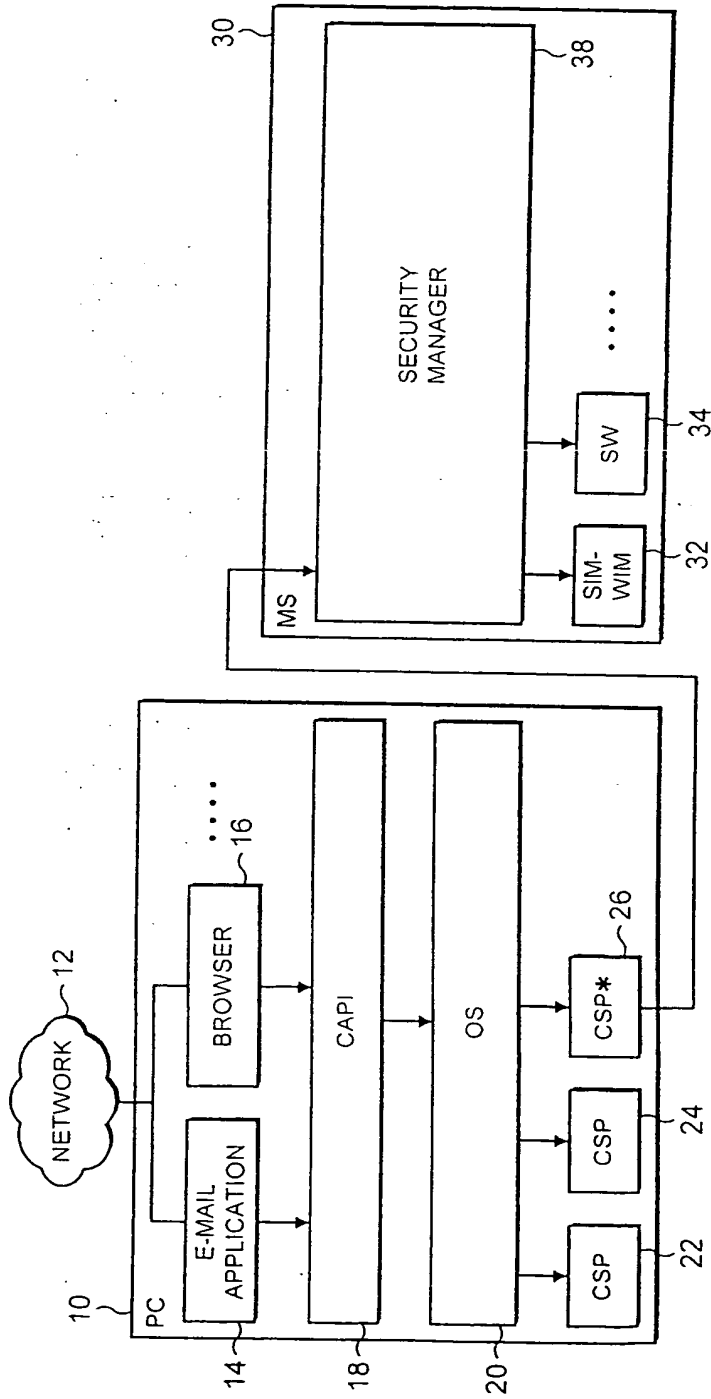35   49.   A module for a computer system as claimed in
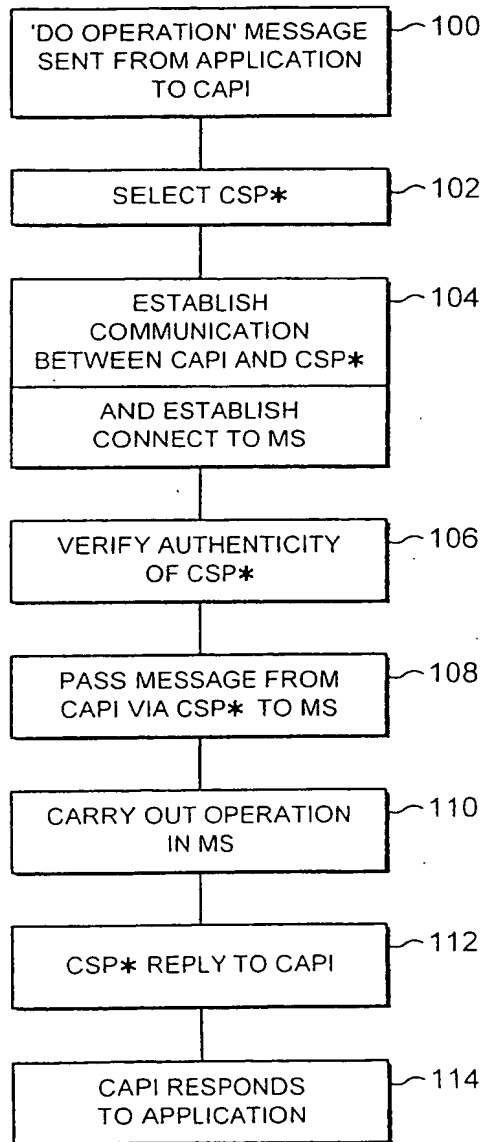
FIG. 1

'DO OPERATION' MESSAGE
SENT FROM APPLICATION
TO CAPI   ⌐100

SELECT CSP∗   ⌐102

ESTABLISH
COMMUNICATION
BETWEEN CAPI AND CSP∗   ⌐104

AND ESTABLISH
CONNECT TO MS

VERIFY AUTHENTICITY
OF CSP∗   ⌐106

PASS MESSAGE FROM
CAPI VIA CSP∗ TO MS   ⌐108

CARRY OUT OPERATION
IN MS   ⌐110

CSP∗ REPLY TO CAPI   ⌐112

CAPI RESPONDS
TO APPLICATION   ⌐114

FIG. 2

SEND 'DO OPERATION' MESSAGE TO SECURITY MANAGER IN MS ~130

SELECT FUNCTIONALITY IN MS ~132

PASS 'DO OPERATION' MESSAGE TO FUNCTIONALITY ~134

CARRY OUT THE OPERATION ~136

REPLY TO PC ~138

FIG. 3

FIG. 4

FIG. 5

'DO OPERATION' MESSAGE
SENT VIA PKCS #11 ———160

SELECT CT* ———162

ESTABLISH
COMMUNICATION BETWEEN
BROWSER AND CT* ———164

ESTABLISH
COMMUNICATION TO MS

MAKE PKCS #11
FUNCTION CALL ———166

CARRY OUT
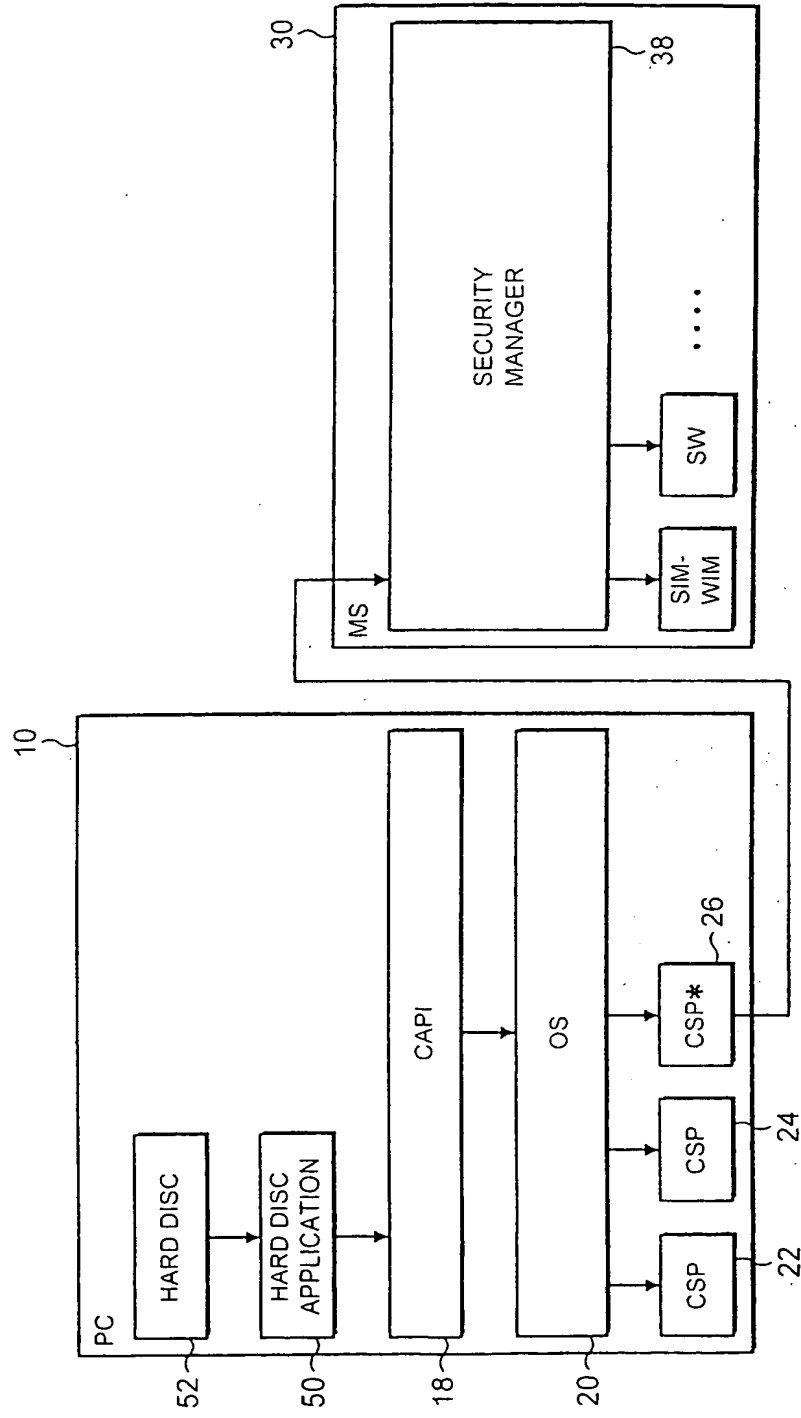OPERATION IN MS ———168

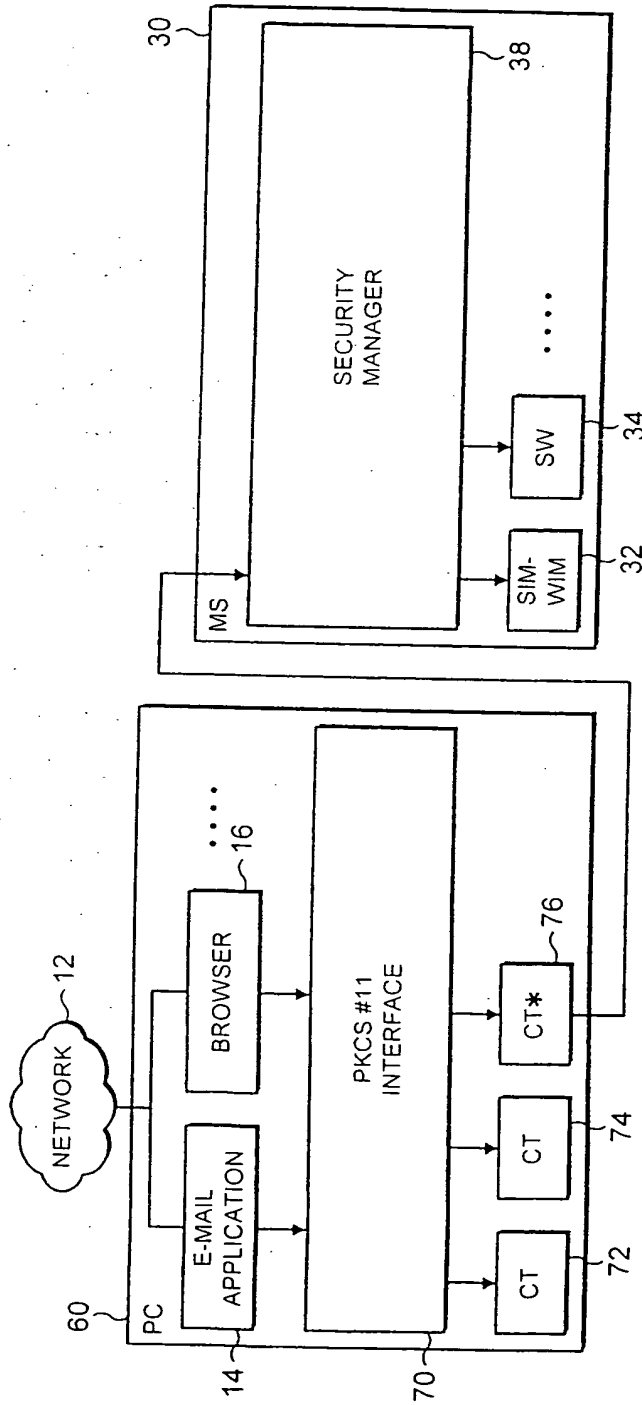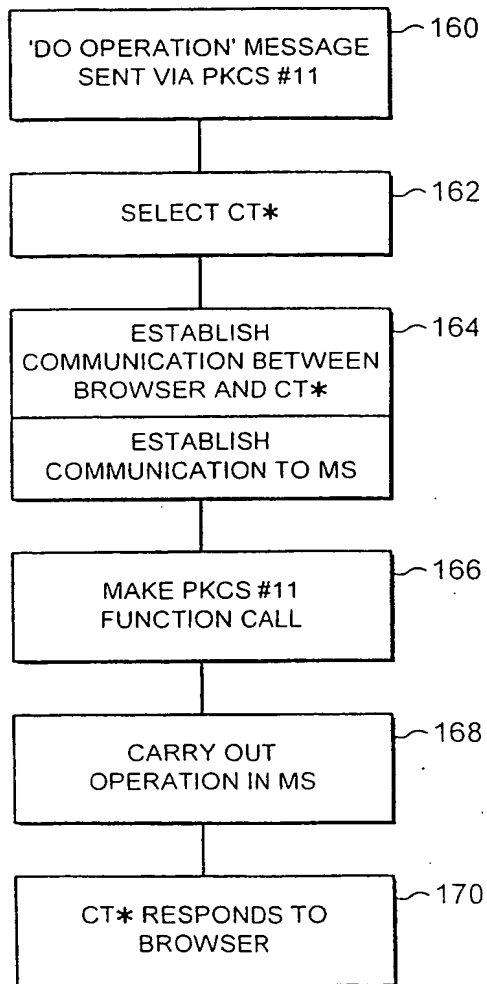CT* RESPONDS TO
BROWSER ———170

FIG. 6

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference HL76380/006	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/EP 01/11888	International filing date *(day/month/year)* 15/10/2001	(Earliest) Priority Date *(day/month/year)* 17/10/2000
Applicant		

TELEFONAKTIEBOLAGET L M ERICSSON (PUBL)

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant - according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of _____2_____ sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the International application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the International application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable (See Box I).**

3. [ ] **Unity of invention is lacking (see Box II).**

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.   1

   [X] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.   [ ] None of the figures.

   [ ] because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04L29/06   H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   H04L   H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 00 02406 A (NOKIA NETWORKS OY ;EKBERG JAN ERIK (FI)) 13 January 2000 (2000-01-13) page 2, line 21 –page 3, line 4 ---	1-50
A	WO 00 20972 A (L 3 COMM CORP) 13 April 2000 (2000-04-13) abstract; claim 1 ---	1-50
A	US 5 878 142 A (AMORUSO VICTOR P ET AL) 2 March 1999 (1999-03-02) column 2, line 21 - line 54 -----	1-50

☐ Further documents are listed in the continuation of box C.   ☒ Patent family members are listed in annex.

* Special categories of cited documents :

'A' document defining the general state of the art which is not considered to be of particular relevance

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'P' document published prior to the international filing date but later than the priority date claimed

'T' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

'X' document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

'Y' document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

'&' document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 July 2002	05/08/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Veen, G

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

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